UNIVERSITI SAINS MALAYSIA

KSCP Semester Examination
Academic Session 2016/2017

August 2017

EPM 322– Industrial Engineering
[Kejuruteraan Industri]

Duration : 3 hours
Masa : 3 jam

INSTRUCTIONS TO CANDIDATE:
ARAHAN KEPADA CALON :

Please check that this paper contains **NINE (9)** printed pages and **FIVE (5)** questions before you begin the examination.

*Sila pastikan bahawa kertas soalan ini mengandungi **SEMBILAN (9)** mukasurat bercetak dan **LIMA (5)** soalan sebelum anda memulakan peperiksaan.*

Appendix*/Lampiran*
1. **Appendix A**/Lampiran A [**3 pages**/*mukasurat*]

Answer **ALL** questions.
*Jawab **SEMUA** soalan.*

Answer all questions in **English** OR **Bahasa Malaysia** OR a combination of both.
*Calon boleh menjawab semua soalan dalam **Bahasa Malaysia** ATAU **Bahasa Inggeris** ATAU kombinasi kedua-duanya.*

Each question must begin from a new page.
Setiap soalan mestilah dimulakan pada mukasurat yang baru.

In the event of any discrepancies, the English version shall be used.
Sekiranya terdapat sebarang percanggahan pada soalan peperikssan, versi Bahasa Inggeris hendaklah diguna pakai.

…2/-

Q1. [a] Provide ONE (1) application each of the following theory for Job Design.

Berikan SATU (1) aplikasi bagi setiap teori berikut untuk Rekabentuk Kerja.

(i) Marslow theory

Teori Marslow

(ii) McGregor X and Y theory

Teori X dan Y McGregor

(**30 marks**/*markah*)

[b] Good Job Design helps to improve productivity.

Rekabentuk Kerja yang baik membantu meningkatkan produktiviti.

(i) Differentiate the meaning of the terms Job Enrichment and Job Enlargement

Bezakan antara maksud terminologi Pengkayaan Kerja dan Pembesaran Kerja.

(ii) State TWO (2) conditions where deployment of Job Enrichment is better to be deployed than Job Enlargement.

Nyatakan DUA (2) keadaan di mana penggunaan Pengkayaan Kerja lebih sesuai daripada Pembesaran Kerja

(**40 marks**/*markah*)

[c] Two different jobs have the Job Rating as shown in Table Q1[c].

Dua pekerjaan berlainan mempunyai Pengkadaran Kerja seperti tertera di Jadual S1[c].

Table Q1[c] Potential motivation for the two jobs
Jadual S1[c] : potensi motivasi bagi dua pekerjaan .

	Skill variation *Variasi Kemahiran*	***Job identiti*** *Jatidiri Kerja*	***Job significance*** *Signifikant Kerja*	**Autonomy** *Otonomi*	***Feedback*** *Timbal balas*
Occupation A *Pekerjaan A*	4	3	6	5	6
Occupation B *Pekerjaan B*	6	2	5	5	1

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(i) Explain briefly ONE(1) of the core job characteristics

Terangkan secara ringkas SATU(1) daripada ciri utama kerja.

(ii) Which job is better in terms of potential motivation? Provide your reasoning.

Pekerjaan yang mana mempunyai potensi motivasi lebih baik . Beri penjelasan anda.

(**30 marks**/*markah*)

Q2. [a] List the THREE (3) primary methods of Poka Yoke systems. Explain the functioning of TWO (2) of the methods.

Senaraikan TIGA(3) kaedah utama sistem Poka Yoke. Terangkan bagaimana DUA (2) daripada kaedah itu berfungsi.

(**30 marks**/markah)

[b] Provide TWO (2) explanation how method improvement can be related to Poka Yoke implementation.

Berikan DUA (2) penerangan bagaimana penambahbaikan kaedah boleh dikaitkan dengan pelaksanaan Poka Yoke.

(30 marks/*markah*)

[c] Before implementing Poka Yoke, The standard time for a job is 12 Standard minute (SM) per part. After implementing Poka Yoke standard time is 10 SM. Assume an operator works at 50 SM an hour at standard performance

Sebelum Poka yoke dilaksanakan masa piawai bagi sesuatu kerja adalah 12 Minit piawai (SM) bagi setiap bahagian, Setelah melaksanakan Poka Yoke , masa piawai bagi menjadi 10 SM. Andaikan pekerja bekerja pada prestasi piawai pada 50 SM sejam.

(i) Calculate the production unit per hour if the operator performance is 90.

Kira jumlah unit pengeluaran per jam jika prestasi pekerja adalah 90.

(ii) Calculate the number of operators required to produce 300 parts in 7 hours/day, if average performance rating is 95.

Kira jumlah pekerja diperlukan jika 300 bahagian diperlukan dalam 7 jam /hari, jika purata prestasi adalah 95.

(**40 marks**/*markah*)

Q3. [a] Explain briefly TWO (2) of the phases in the productivity cycle.

Terangkan secara ringkas DUA (2) dari fasa dalam kitaran produktiviti.

(**20 marks**/*markah***)**

[b] Give TWO (2) methods to improve employee's productivity and EXPLAIN how improvement to work method can increase the productivity of employees

*Berikan DUA (2) cara bagi meningkatan produktiviti pekerja dan TERANGKAN bagaimana penambaikan kaedah kerja mampu meningkatkan produktiviti pekerja***.**

(**35 marks**/*markah*)

[c] The following data in Table Q3[c] are collected from a manufacturing company over the period of three years.

Data yang di pamer dalam Jadual S3[c] di kumpul dari sebuah syarikat pembuatan sepanjang tiga tahun.

Table Q3[c]: Financial Performance From 2014-2016

Jadual Q3[c] : Prestasi kewangan dari 2014-2016

	2014 RM juta	**2015 RM juta**	**2016 RM juta**
Total sales *Jualan Total*	RM 300	RM 310	RM 320
Labour cost *Kos pekerja*	RM 40	RM 45	RM 50
Base lending rate *Kadar pinjaman asas*	5.5 %	6.0%	6.25%
Material cost *Kos bahan*	RM 60	RM 60	RM 70,
Other tangible cost *Kos nyata lain*	RM 20,	RM 22	RM 26,

(i) Calculate Total Productivity based on Gross Profit of year 2014, 2015, and 2016.

Kira Produktiviti Menyeluruh berdasarkan ***Keuntungan Kasar*** *(bagi tahun 2014,2015 dan 2016.*

(ii) Calculate the productivity Index for 2015 and 2016.

Kira indeks produktiviti bagi 2015 dan 2016.

(iii) Comment on the company's achievement in terms of productivity in the period based in Q3[c](ii).

Beri komen pencapaian syarikat dari segi produktiviti dalam jangkamasa berdasarkan S3[c](ii).

(**45 marks**/*markah*)

Q4. Based from the information of the case study given in Appendix A;

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Berdasarkan maklumat kajian kes yang diberikan dalam Apendik A;

[a] What is the maximum smelting capacity for the SSP furnace?

Apakah kapasiti peleburan maksima untuk relau SSP?

(10 marks/*markah)*

[b] Calculate the total time to complete the packing process for 1500kg of solder plumbs.

Kira jumlah masa yang diperlukan untuk menyiapkan kerja pembungkusan untuk 1500kg solder plumb.

(20 marks/*markah)*

[c] What is the total time save (in minutes) if SSP were to produce two charge without any delay?

Berapakah jumlah masa (dalam minit) yang akan dijimatkan sekiranya SSP menghasilkan dua caj tanpa henti?

(10 marks/*markah)*

[d] Calculate the total productive man-hours available for SSP in a day.

Kira jumlah waktu produktif pekerja-jam sehari untuk SSP.

(30 marks/*markah)*

[e] Manpower cost is RM8.00 per man/hour whereas for overtime, the cost is RM20.00 per man/hour. Find the total man power cost for THREE (3) workers to complete the packing process for an order of 1500kg within twenty four (24) hours after receiving the work order.

Kos pekerja adalah RM8.00 orang/jam manakala kos pekerja untuk kerja lebih masa adalah RM20.00 orang/jam. Kira jumlah kos TIGA (3) pekerja yang diperlukan untuk menyiapkan kerja pembungkusan untuk satu tempahan sebanyak 1500kg dalam tempoh dua puluh empat (24) jam setelah arahan kerja di terima.

(30 marks/*markah)*

Q5. Based from the information of the case study given in Appendix A;

Berdasarkan maklumat kajian kes yang diberikan dalam Apendik A;

[a] Suggest FOUR (4) suitable approaches that will improve the EMSB performance. One suggestion must apply the Incentive Scheme approach. State your reason for every suggestion that you proposed.

Cadangkan EMPAT (4) pendekatan yang sesuai untuk meningkatkan prestasi produktiviti EMSB. Satu cadangan hendaklah mengaplikasikan Skim Insentif. Nyatakan sebab untuk setiap cadangan yang dinyatakan.

(50 marks/*markah)*

[b] Construct a detail "Process Flow Chart" for SSP and state the time required for each process with reference to Exhibit 3.

Bina satu "Carta Aliran Proses" SSP yang lengkap serta nyatakan masa yang diperlukan untuk setiap proses dengan merujuk "Exhibit 3".

(50 marks/*markah)*

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APPENDIX A
LAMPIRAN A

The following case study is for Q4 and Q5.
Kajian kes berikut adalah untuk S4 dan S5.

You are appointed as a consultant, thus your task will involve solving all the questions pertaining to the operation of the EM SB plant, which is listed below. Please read the case study to gather information/data before answering the questions.

Anda telah dilantik sebagai perunding maka, tugas anda adalah untuk menyelesaikan semua persoalan tentang operasi loji EM SB seperti yang disenaraikan dibawah. Mohon baca kajian kes bagi mengumpul maklumat/data sebelum menjawab soalan.

OVERVIEW
EM Sdn. Bhd. (EM SB) produces various type of solder material used in electronic industry. The process of producing solder material are carried out in the company from the initial stage i.e. melting and casting it into ingots before performing a secondary manufacturing processes which produces solder plumb. **Exhibit 1** shows the manufacturing flow at EM SB.

The demand of solder product had increased tremendously and the only effected section is Section Solder Plumb (SSP) because that section had to do overtime and out-sourcing to meet the order. Based on the report from Marketing/Sales department the trend of demand will be increasing drastically.

General observation shows that "bottlenecking" occurs at the packing area in the SSP production line because SSP had the most WIP at the Storage Area compared from other sections.

CURRENT OPERATION
SSP runs only one (1) shift per day (8 hours/shift) with 3 production operators. A total of 1500kg solder ingots which is equivalent to one (1) charge, are loaded into the furnace with the aid of manual crane. The maximum capacity of the furnace is 1600kg and according to the Standard Operating Procedure (SOP), one (1) charge of solder is 1500kg. During the smelting process, an agitator will stir the molten solder to ensure there will be no segregation of the charge.

After complete smelting, the valve will be open to transfer the molten solder charge via a pump to the casting area. The molten solder is cast into a mould to produce solder plumb (see **Exhibit 1**). Solidify solder plumbs are then ejected into the container beneath the mould. One container can hold approximately 500kg of plumbs. Full container will then be manually transferred using forklift truck to the Storage Area. The solder plumbs are placed at that area to allow it to be cool before packing process takes place. The Storage Area can store a maximum of ten (10) containers equivalent to 5000kg at any one time.

For packing operation, the container is transferred to the Packing Area. The solder plumbs are put inside a plastic packet and simultaneously weigh to obtain 2.5kg/packet. The packets are then sealed and arranged into a wooden box for shipment. **Exhibit 2** shows the schematic manufacturing process of the solder plumb.

In order to meet the demand SPP department requires their workers to work overtime. Constraint in overtime is that a worker can only work up to sixteen (16) hours per day. The labour law had stated that a worker must have minimum eight (8) hours of rest before commencing work after a continuous sixteen (16) hours of work.

OBSERVATION AND FINDING

- Based from direct time study and historical data, the Furnace and the Casting equipment are under utilise because setting up the furnace i.e. heating and setting the process parameters will require 1 hour and loading of solder ingots for one (1) charge into the furnace will take about 1 hour.

- For the solder ingots to melt, complete the casting process for one charge of the solder plumb and discharge it into the container beneath the mould, will take another 1.5 hours.

- Transferring standard time of container takes about 15 minutes from the Pouring & Casting area to the Storage Area. Another 15 minutes is required to transfer the container from Storage Area to the Packing Area.

- The standard cooling time of the solder plumbs at the WIP Storage Area will take about 1 hour.

- Bottleneck occurs at the packing operation because currently it requires 15 hours to pack 1500kg of solder plumbs. To complete the packing of 1500kg on the same day, the operators have to do overtime.

- For the packing process, the operator will scoop the solder plumbs, do physical inspection and put into the plastic packet that is placed on the weighing scale. Plumbs are repeatedly handle because the operator need to remove and add to get the exact weight of 2.5kg/packet of plumb. The operator will then seal the packet using a manual sealer which requires a standard time of 0.1 minute.

- Delay in packing process due to the same three (3) operators will share the tasks of remelting, casting, and transferring the container. It is also observed that beginning of shift, each operator was given a specific task i.e. One (1) operator X will take charge of smelting and casting, One (1) operator Y will handle all the material handling equipment i.e. the crane to load the solder ingots and the forklift to transfer the container to the storage area. One (1) operator Z will do the packing. When operator X and Y have completed their task or have some idle time, they will help the packing.

- High WIP because in order to meet high demands, SSP will make 2 (two) continuous charge i.e. 3000kg in one shift to buffer for the packing process. Continuous charge will save 1 hour of setting-up time of the furnace.

- Productive man hours available per shift is only 7 hours (1 hour lunch break) and man power efficiency is at 85% after considering the PFD Allowance.

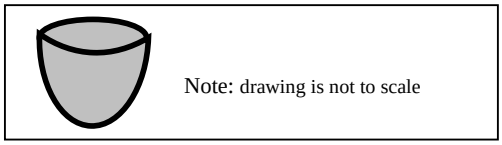

Exhibit 1: Solder Plumb

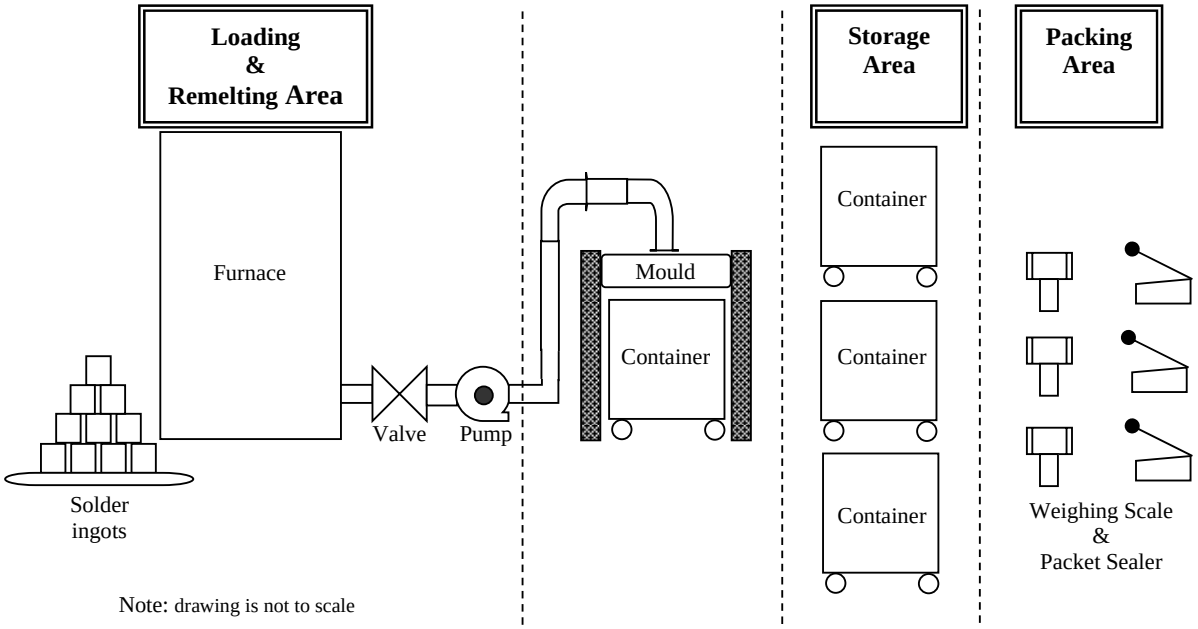

Exhibit 2: Solder Plumb Schematic Manufacturing Process

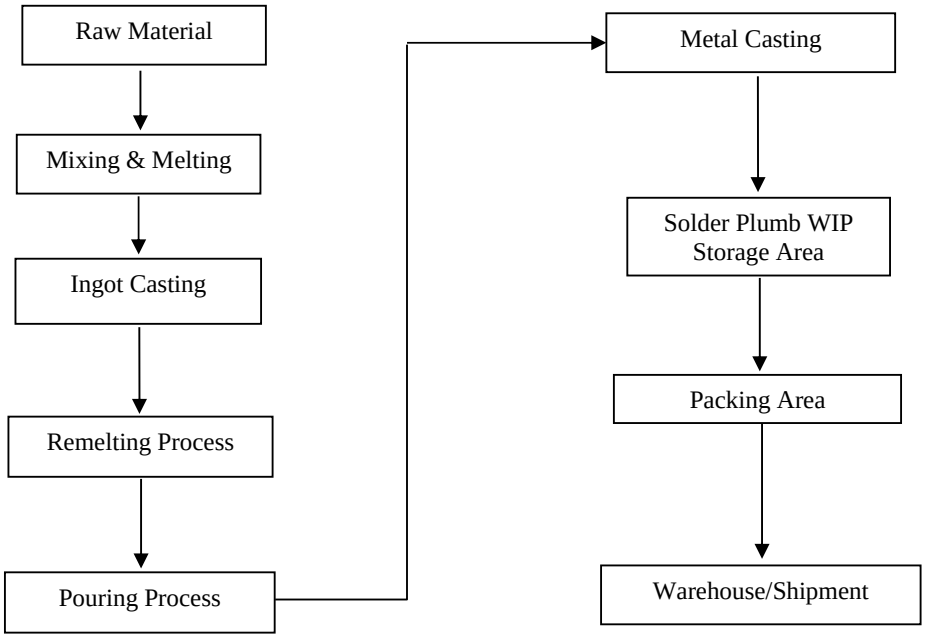

Exhibit 3: Solder Plumb Manufacturing Flow